



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit: 2632
Examiner: Julie Lieu
Applicant: Alfred H. Judge
Serial No. 09/636,272
Filed: August 10, 2000
For: POWER TOOL LEVEL INDICATOR
Attorney Docket No. 0275S-000379

Hon. Commissioner of Patents
And Trademarks
Washington, D.C. 20231

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APPEAL BRIEF

Sir:

This is an appeal from the August 6, 2001 final rejection of Claims 25 through 31, and 33 through 37 in the above identified application. Claim 32 is objected to. A copy of the Examiner's Final Office Action dated August 6, 2001 is attached as Exhibit A.

Claims 35 through 31 are rejected under 35 U.S.C. §103(a) as being unpatentable over Bein et al in view of Jansky.

REAL PARTY IN INTEREST

Black & Decker is the real party in interest, being the assignee of the present application.

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RELATED APPEALS AND INTERFERENCES

To the best of Applicant's knowledge, no other appeals or interferences are pending which will directly affect or be directly affected by or have a bearing on the Board's decision in the present pending appeal.

STATUS OF THE CLAIMS

Claims 25 through 31 stand finally rejected as attached in Exhibit B. Claim 32 is objected to. Claims 33 through 37 are allowable if rewritten in independent form.

SUMMARY OF THE INVENTION

The invention relates to power tools, and specifically to drill motors (10) which include a leveling device (30). The power tool (10) includes a housing (12) as seen in Figure 1. A motor (18) is positioned within the housing (12), see Figure 2. The output (28) is coupled with the motor (18). An activation member (20) energizes the motor (18) to rotate the output (28). A power source (22) is electrically coupled with the motor (18) and the activation member (20). A leveling mechanism (30) comprises a light emitting device (38, 40) coupled with the power tool housing (12). The light emitting device (38, 40) illuminates to indicate to a user that the power tool (10) is in a horizontal or vertical position. See Figures 1 and 2. A copy of the patent application is attached as Exhibit C.

ISSUE

Applicant presents the following issue for review:

- 1) Whether or not claims 25 through 31 are unpatentable under 35 U.S.C. §103(a) over Bein et al in view of Jansky.

GROUPING OF THE CLAIMS

Claims 25 through 31 stand or fall together.

ARGUMENT

BACKGROUND OF THE INVENTION

The present invention relates to power tools and, more specifically, to a leveling device which indicates when the power tool is in a horizontal or vertical plane.

In various types of power tools, especially drilling tools, it is desirable to know when the tool is in a horizontal or vertical plane. This is particularly useful when drilling holes for hanging doors or the like when it is desirable to have holes which are in a horizontal plane.

Bubble type of levels have been utilized in power tools. However, these types of leveling devices have various shortcomings. While the bubble level works satisfactory for horizontal applications, it is extremely burdensome on the user to view the bubble when it is in-between the lines. Ordinarily, the bubble types of levels are not conducive for vertical drilling. Also due to vibration of the tool, frothing occurs inside the level, rendering the bubble level useless in many applications.

Another type of measuring device utilizes a simple pendulum with a rigid straight bar connecting the pivot point with a hanging weight together with a cross bar mounted at 90 degrees to a vertical bar. The cross bar can be disposed on either side of the pivot

point when the pivot point is hung and the weight achieves equilibrium, the cross bar will be positioned in a horizontal plane. Accordingly, the ends may be aligned with two notches on a carrier board to align the board to the horizontal and thus measure the horizontal plane. Both of these devices require the user to get an accurate view during drilling to maintain the plane of the power tool. Also, why these types of devices may be satisfactory for horizontal planes, they are not particularly useful when used in vertical drilling arrangements. Thus, the present invention provides the art with an easy to use leveling device for a power tool. The device indicates to the user, usually by an illuminating light, that the horizontal or vertical planes have been achieved. The present invention enables the user to readily establish visual contact to indicate that the desired plane has been achieved.

The combination of Bein et al and Jansky fail to render Applicant's invention obvious to those skilled in the art. It is respectfully submitted that the Examiner is misapplying the references and is utilizing hindsight to reconstruct Applicant's invention.

The Examiner has rejected Claims 25 through 31 under 35 U.S.C. §103(a) alleging them to be unpatentable over Bein et al in view of Jansky. A copy of the Examiner's Final Rejection and a copy of the references are attached to this Appeal Brief as Exhibits A, D, and E.

Claim 25 defines, among other elements, a power tool which includes a leveling mechanism with a light emitting device coupled with the power tool housing. The light emitting device illuminates to indicate to a user that the power tool is in a horizontal or vertical position.

The Bein et al reference cited by the Examiner discloses a level indicating device in a staff level. In the background of the invention, Bein disclose that the level may be placed at a site that is not accessible to a person and thus the observer of the level must remain at a location remote from the level's location. Further, Bein et al points out that lighting conditions at the workplace are not always ideal for reading a conventional gas type level. Bein indicates that the level may emit an audible or visual signal to enable workmen to make adjustments without requiring the presence of a second workman. See column 1 lines 12 through 22 of the Bein et al reference. ✓

Bein et al in the summary of their invention, indicates that it is the principal object of the invention to provide a device capable of detecting a truly horizontal or truly vertical condition and indicate the same to a remote interested party, consecutively and without repositioning the device or resetting the device. See column 1 lines 45 through 49. Accordingly, the object of this invention is to enable a remote interested party to know when a level position has been achieved. Thus, the Bein et al disclosure as well as Claim 1, both relate to a staff level. This is indicated in Claim 1, where it claims the housing has at least one planar surface. Further, the level itself is a self-contained unit within the elongated housing.

The Examiner combines Jansky to allege obviousness in combination with Bein et al. Jansky discloses an auxiliary level that is added to a position outside of the housing of a drill. The level has an elbow shape having bubble levels on both ends. The Examiner alleges that this combination will render applicant's invention obvious to those skilled in the art. Clearly this is not the case.

The Court of Appeals for the federal circuit established obviousness criteria *In Re Fritch*, 23 US PQ 2d 1780. The Court stated:

"Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching or suggestion supporting the combination. Under section 103, teachings of references can be combined *only* if there is some suggestion or incentive to do so. Although couched in terms of combining teachings found in the prior art, the same inquiry must be carried out in the context of a purported obvious "modification" of the prior art. The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." at 1783 emphasis original.

Here, the two references, Bein et al and Jansky both solve different problems. Bein et al is interested in providing an audible or visual sensor in a staff level which is in a level position to notify a remote person of the levelness. There is no motivation to combine the staff level with the auxiliary leveling device of Jansky.

As was further stated by the Court of Appeals *In Re Fritch*:

The Examiner is relying upon hindsight to arrive at the determination of obviousness. It is impermissible to use the claimed invention as an instruction manual or template to piece together the teachings of the prior art so that the claimed invention is rendered obvious. This court has previously stated that:

"[o]ne cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention."

In re Fritch, supra, 1784.

This is exactly what the Examiner has done in applying the Section 103 rejection. The Examiner has not viewed either reference as a whole but has only extracted a single

element from the Jansky reference and applied it with Bein et al. Clearly, this is not the proper application of references under Section 103.

Claims 25 through 31 stand or fall together. Accordingly, applicants believe the above grouping to be proper.

CONCLUSION

Applicants respectfully submit that the Examiner has failed to provide prior art which obviates applicants invention. Likewise, the Examiner has failed to provide art which would establish a prima facie case of obviousness.

Applicants invention provides the art with a power tool with a leveling device which indicates to the user horizontal or vertical level positions of the power tool. Accordingly, reversal of the final rejection of Claims 25 through 31 and allowance of the claims is respectfully requested.

Respectfully submitted,

HARNESS, DICKEY & PIERCE, P.L.C.

Dated: April 11, 2002

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Attorney Docket No. 0275S-000379

WRDT/ad
Enclosures

BY: 

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02755-000379 ✓ 2008
2008

09 June

OUE 11-6-01

Office Action Summary

Application No.

09/636,272

Applicant(s)

JUDGE, ALFRED H.

Examiner

Julie Lieu

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 May 2000.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 25-37 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 25-31 and 33-37 is/are rejected.
- 7) ☒ Claim(s) 32 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

1. This Office action is in response to the amendment filed May 29, 01. All original claims have been canceled. New claims 25-37 have been added.
2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 33-37 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 33, "said cavity" lacks antecedent basis. It appears that claim 33 should depend on claim 26. Correction or verification is required.

Claim Rejections - 35 USC § 103

1. Claims 25-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bein et al. (US Patent No. 4,703,315) in view of Jansky (US Patent No. 4,141,151).

Claims 25-26:

- Bein et al. discloses a leveling mechanism comprising: - SELF CONTAINED
LEVEL - PLANNED SURFACES
- a. a housing, a cavity in said housing (fig. 1)
 - b. a rotating member 46 in said housing moving in the cavity such that the rotating member seeks an equilibrium position which corresponds to a horizontal or vertical plane;
 - c. electrical contacts 52, 58 coupled with said rotating member and only completing an electrical circuit when said rotating member is in the equilibrium position;
 - d. an indicator 30,32 electrically coupled with said electrical contacts for indicating to a user when the mechanism is in an equilibrium position; and
 - e. A power source 18 coupled with said electrical contacts and said indicator for energizing said indicator when said electrical circuit is complete.

The level mechanism in Bein indicate whether the level condition is vertical or horizontal. As stated in col. 1, lines 9-11, it appears that the level indicating device in Bein is used with a workpiece, though it is not clear whether the work piece is a power tool or not. However, the use of a level condition indicating device in power tool, such as a portable electric power drill, comprising:

- a. a housing
- b. a motor within the housing
- c. an output coupled to the motor
- d. an activation member for energizing the motor for rotating the output

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is conventional in the art as shown in Jansky. Therefore, it would have been obvious to one skilled in the art to use the leveling device of Bein with the power tool of Jansky in place of the bubble leveling device in Jansky because the leveling devices are functionally equivalent and also the LED indicator would provides more visual effect than just a bubble since it could be recognized more clearly from a remote position than the bubble leveler.

Claim 27:

The rotating member 46 is being fixed for rotation about a center axis 48 in the cavity in said housing. The housing 11 is rectangular in shape. However, one skilled in the art would have readily recognized using an appropriate shape of a housing the for the leveling device in Bein depending on its application but the shape of the housing for the device would not alter the function of the leveling device.

Claim 28:

The rotating member 46 includes a biased electrical contact 52 or 58. Col. 6 lines 23-27.

Claim 29:

The electrical contacts in Bein is a pair of conductive members coupled with the housing. Each member includes electrical contact portions spaced 90 degrees from one another about the circuit such that as the rotating member reaches the equilibrium position, the rotating member biased electrical member contacts the annular rings electrical contact portions completing the circuit and activating the indicator. Figs. 1 and 3.

Claim 30:

The rotating member 46 could be manufactured from an electrically conducting material. Col. 5 lines 47-51.

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Claim 31:

The rotating member 46 is partially cylindrical. It is not totally cylindrical and does not have at least one projecting member. However, one skilled in the art would have readily recognized that the rotating member in Bein without the projecting member would be functionally equivalent with the claimed cylindrical rotating member.

Allowable Subject Matter

1. Claim 32 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
2. Claims 33-37 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Applicant's Remarks

The applicant has argued that there is no motivation or suggestion to combine Bein with Jansky and the examiner is utilizing hindsight in an attempt to combine the two references.

Response to Applicant's Remarks

Applicant's arguments filed May 29, 01 have been fully considered but they are not persuasive.

Regarding suggestion or motivation in the references to combine the two cited prior arts to Bein and Jansky, and examiner's attempt to use hindsight, refer to Bein, background of the invention section.

The suggestion or motivation is stated in Bein that a leveling device is conventionally used in a workpiece and also in Jansky, a leveling device is clearly shown used in a powered workpiece. It would have been obvious to one skilled in the art to readily recognize combining the teachings of these two references for the reason stated in the rejection above and in light of suggestion made in both references.

Further, there is no requirement that a motivation to make the modification be expressly articulated. The test for combining references is what the combination of disclosures taken as a whole would suggest to one of ordinary skill in the art. In re McLaughlin, 170 USPQ 209 (CCPA 1971). References are evaluated by what they suggest to one versed in the art, rather than by their specific disclosures. In re Bozek, 163 USPQ 545 (CCPA) 1969.

Regarding the applicant's assertion that the examiner has attempted to make a hindsight reconstruction, it must be recognized that any judgement on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was

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made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

Conclusion

1. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

2. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Julie Lieu whose telephone number is 703-308-6738. The examiner can normally be reached on Mon-Thurs, 9:00am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey Hofsass can be reached on 703-305-4717. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9314 for regular communications and 703-872-9314 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-3900.



Julie Lieu
Primary Examiner
Art Unit 2632

jl
July 31, 2001

Attachment for PTO-948 (Rev. 03/01, or earlier)
6/18/01

The below text replaces the pre-printed text under the heading, "Information on How to Effect Drawing Changes," on the back of the PTO-948 (Rev. 03/01, or earlier) form.

INFORMATION ON HOW TO EFFECT DRAWING CHANGES

1. Correction of Informalities -- 37 CFR 1.85

New corrected drawings must be filed with the changes incorporated therein. Identifying indicia, if provided, should include the title of the invention, inventor's name, and application number, or docket number (if any) if an application number has not been assigned to the application. If this information is provided, it must be placed on the front of each sheet and centered within the top margin. If corrected drawings are required in a Notice of Allowability (PTOL-37), the new drawings **MUST** be filed within the **THREE MONTH** shortened statutory period set for reply in the Notice of Allowability. Extensions of time may **NOT** be obtained under the provisions of 37 CFR 1.136(a) or (b) for filing the corrected drawings after the mailing of a Notice of Allowability. The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson.

2. Corrections other than Informalities Noted by Draftsperson on form PTO-948.

All changes to the drawings, other than informalities noted by the Draftsperson, **MUST** be made in the same manner as above except that, normally, a highlighted (preferably red ink) sketch of the changes to be incorporated into the new drawings **MUST** be approved by the examiner before the application will be allowed. No changes will be permitted to be made, other than correction of informalities, unless the examiner has approved the proposed changes.

Timing of Corrections

Applicant is required to submit the drawing corrections within the time period set in the attached Office communication. See 37 CFR 1.85(a).

Failure to take corrective action within the set period will result in **ABANDONMENT** of the application.



**UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office**

Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/6026, 172 08/10/00 JUNE

A 02750-000375

TM02/0906

HARNES & PIERCE PLC
PO BOX 818
BLOOMFIELD HILLS MI 48303

EXAMINER

LIFILL

ART UNIT

PAPER NUMBER

2632

DATE MAILED:

08/06/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

EXHIBIT "B"

Rejected Claims

25. A power tool comprising:
- a housing;
 - a motor within said housing;
 - an output coupled with said motor;
 - an activation member for energizing said motor for rotating said output;
 - a power source electrically coupled with said motor and said activation member; and
 - a leveling mechanism comprising a light emitting device coupled with said power tool housing, said light emitting device illuminating to indicate to a user that the power tool is in a horizontal or vertical position.
26. The power tool according to Claim 25, said leveling mechanism further comprising:
- a housing coupled within said power tool housing;
 - a cavity in said housing;
 - a rotating member in said housing, said rotating member moving in said cavity such that said rotating member seeks an equilibrium position which corresponds to a horizontal or vertical plane;

electrical contacts in contact with said rotating member, said electrical contacts only completing an electrical circuit when said rotating member is in said equilibrium position;

said light emitting device electrically coupled with said electrical contacts;
and

said power source coupled with said electrical contacts for illuminating said light emitting device when the circuit is complete.

27. The power tool according to Claim 26, wherein said rotating member being fixed for rotation about a center axis in a cylindrical cavity in said housing.

28. The power tool according to Claim 27, wherein said rotating member includes a biased electrical contact.

29. The power tool according to Claim 27, wherein said electrical contacts being a pair of annular members coupled with said housing, each said annular member including electrical contact portions spaced ninety (90°) degrees from one another about a circle such that as said rotating member reaches said equilibrium position, said rotating member biased electrical member contacts said annular rings electrical contact portions completing the circuit and activating said indicator.

30. The power tool according to Claim 27, wherein rotating member being manufactured from an electrically conducting material.

31. The power tool according to Claim 30, wherein said rotating member being cylindrical with at least one projecting member.

POWER TOOL LEVEL INDICATOR

Background and Summary of the Invention

The present invention relates to power tools and, more particularly, to a leveling device that indicates when the power tool is in a horizontal or vertical plane.

5 In various types of power tools, especially drilling tools, it is desirable to know when the tool is in a horizontal or vertical plane. This is particularly useful when drilling holes for hanging doors or the like when it is desirable to have holes which are in plane with horizontal.

Bubble type of levels have been utilized in power tools. However, these types of leveling devices have various shortcomings. While the bubble level works
10 satisfactorily for horizontal applications, it is still burdensome on the user to view the bubble in between the lines. Ordinarily, these bubble types of levels are not conducive for vertical drilling. Also, due to the vibration of the tool, frothing occurs inside the level, rendering the bubble level useless in many applications.

Another type of measuring device utilizes a simple pendulum with a rigid
15 straight bar connecting the pivot point with a hanging weight together with a cross bar mounted at ninety (90°) degrees to a vertical bar. The cross bar can be disposed on either side of the pivot point when the pivot level is hung and the weight achieves equilibrium, the cross bar will be positioned in a horizontal plane. Accordingly, the ends may be aligned with two notches on a carrier board to align the board to the
20 horizontal and thus measure the horizontal plane.

Both of these devices require the user to get an accurate view during drilling to maintain the plane of the power tool. Also, while these types of devices may be satisfactory for horizontal planes, they are not particularly useful when used in a vertical drilling arrangement.

Accordingly, it is an object of the present invention to provide a user with an easy to use leveling device. The device indicates to the user, usually by an illuminated light, that horizontal or vertical planes have been achieved. The present invention enables the user to readily establish visual contact to indicate that a desired plane has been achieved.

According to a first embodiment of the present invention, a mechanism for determining if a power tool is in a horizontal or vertical plane comprises a housing with a cavity in the housing. A rotating member is positioned within the housing. The rotating member moves in the cavity such that the rotating member seeks an equilibrium position which corresponds to a horizontal or vertical plane. Electrical contacts are coupled with the rotating member such that the electrical contacts only complete an electrical circuit when the rotating member is in the equilibrium position. An indicator is electrically coupled with the electrical contacts to indicate to the user when the mechanism is in an equilibrium position. A power source is electrically coupled with the electrical contacts and the indicator to energize the indicator when the circuit is complete. The rotating member may be fixed for rotation about a central axis in a cylindrical cavity in the housing. Here, the rotating member includes a biased electrical contact. The electrical contacts include a pair of annular members coupled with the housing. Each annular member includes electrical contact portions spaced ninety (90°) degrees from one another. Thus, as the rotating member reaches the equilibrium position, the rotating member's biased electrical member contacts the annular ring electrical contact portions to complete the circuit and activating the indicator. Alternatively, the rotating member could be manufactured from an electrical conductive material. Here, the rotating member is cylindrical and has at least one projecting member. The electrical contacts include a biased member to electrically contact the at least one projecting member when the cylindrical rotating member is in

the equilibrium position. An axle projects through the cylindrical rotating member to complete the circuit. Alternatively, the cavity may be defined by a pair of opposing conductive conical members acting as the electrical contacts. Here, the rotating member includes a pair of conductive balls. The opposing conductive cylindrical members are separated by a non-conductive membrane. The membrane includes apertures positioned at ninety (90°) degrees apart from one another about a circle. The balls contact one another through the apertures in the membrane when the balls are in the equilibrium position to complete the circuit and activate the indicator.

In accordance with a second embodiment of the present invention, a power tool comprises a housing with a motor within the housing. The motor is coupled with an output. An activation member is coupled with a power source which, in turn, is coupled with the motor. The activation member is activated which, in turn, energizes the motor to drive the output. A leveling mechanism is coupled with the housing. The leveling mechanism comprises a housing with a cavity in the housing. A rotating member is positioned within the housing. The rotating member moves in the cavity such that the rotating member seeks an equilibrium position which corresponds to a horizontal or vertical plane. Electrical contacts are coupled with the rotating member such that the electrical contacts only complete an electrical circuit when the rotating member is in the equilibrium position. An indicator is electrically coupled with the electrical contacts to indicate to the user when the mechanism is in an equilibrium position. A power source is electrically coupled with the electrical contacts and the indicator to energize the indicator when the circuit is complete. The rotating member may be fixed for rotation about a central axis in a cylindrical cavity in the housing. Here, the rotating member includes a biased electrical contact. The electrical contacts include a pair of annular members coupled with the housing. Each annular member includes electrical contact portions spaced ninety (90°) degrees from one another.

Thus, as the rotating member reaches the equilibrium position, the rotating member's biased electrical member contacts the annular ring electrical contact portions to complete the circuit and activate the indicator. Alternatively, the rotating member could be manufactured from an electrical conductive material. Here, the rotating member is cylindrical and has at least one projecting member. The electrical contacts include a biased member to electrically contact the at least one projecting member when the cylindrical rotating member is in the equilibrium position. An axle projects through the cylindrical rotating member to complete the circuit. Alternatively, the cavity may be defined by a pair of opposing conductive conical members acting as the electrical contacts. Here, the rotating member includes a pair of conductive balls. The opposing conductive cylindrical members are separated by a non-conductive membrane. The membrane includes apertures positioned at ninety (90°) degrees apart from one another about a circle. The balls contact one another through the apertures in the membrane when the balls are in the equilibrium position to complete the circuit and activate the indicator.

Additional objects and advantages of the present invention will become apparent from the detailed description of the preferred embodiment, and the appended claims and accompanying drawings, or may be learned by practice of the invention.

Brief Description of the Drawings

Figure 1 is a plan view of a drill with a leveling device in accordance with the present invention.

Figure 2 illustrates a perspective view with both housing halves.

Figure 3 is an exploded perspective view of a level indicator in accordance with the present invention.

Figure 4 is an exploded perspective view of a level indicator in accordance with the present invention.

Figure 5 is an exploded perspective view of an additional embodiment of a level indicator in accordance with the present invention.

5 Detailed Description of the Preferred Embodiment

Turning to the figures, Figure 1 illustrates a power tool in accordance with the present invention and is designated with the reference numeral 10. The power tool 10 is illustrated as a drill; however, any type of power tool such as a screwdriver, sander, rotary tool, clippers, saw or the like can be utilized with the level indicator in accordance with the present invention. The power tool 10 includes a housing 12 which includes two halves 14 and 16, which surround a motor 18. An activation member 20 is coupled with the motor 18 as well as with a power source 22. The power source 22 may be a power cord (AC current) or the power tool may have a battery (DC current) as shown. The motor 18 is coupled with an output 24 which may include a transmission 26 and a chuck 28 to retain a tool (not shown) with the drill.

Looking at housing half 14 in Figure 2, a level indicator is shown and designated with the reference numeral 30. The level indicator 30 has wires 32 and 34 extending therefrom. Wire 32 extends down and is coupled with the battery 22, and wire 34 extends up to indicator LEDs 38 and 40 with wire 42 leading back to the battery 22. LED 38 is positioned on top of the drill housing 12, while LED 40 is positioned at the rear of the drill. Both the indicator lights illuminate light when the drill is in a horizontal plane and vertical plane, respectively. Thus, the lights 38, 40 can be seen by the user when the drill is in several different orientations.

Turning to Figure 3, an exploded view of the level indicator 30 is shown. The level indicator 30 includes a housing 50 which defines a cylindrical cavity 52.

Positioned within the cavity 52 is a rotatable pendulum member 54. The pendulum member 54 is fixed about an axle 56. Accordingly, the pendulum member 54 rotates within the cylindrical cavity 52 about the axle 56. The pendulum member 54 is weighted such that the rotating pendulum member 54 always seeks an equilibrium position. The pendulum 54 has an overall D-shape. At the bottom of the curved portion, the rotating pendulum member includes a bore 58. The bore includes a pair of conductive balls 60 and 62, on each side of the rotating pendulum member 54 as well as a conductive spring 64 biasing the balls 60 and 62 away from one another.

Electrical contact rings 66 and 68 are held at the sides of the cavity 52 by non-conductive shells 70 and 72 which enclose the cavity of the housing 50. The conductive rings 66 and 68 are coated with a non-conductive material such that portions 74 of the ring are exposed for conductive purposes. The portions 74 are spaced at ninety (90°) degree intervals about the ring. Also, the rings 66 and 68 are coupled with wires 32 and 34 to complete the electrical circuit.

In use, the rotating pendulum member 54 is capable of rotating about the axle 56 in a three hundred sixty (360°) degree circle in the housing cavity 52. As the drill is manipulated, the pendulum reaches an equilibrium position. When the drill is in a horizontal or vertical plane, the conductive balls 60 and 62 in the rotated pendulum member 54 contact a conductive portion 74 on rings 66 and 68. As this occurs, the LEDs 38 and 40 are illuminated. This indicates to the user that the drill is in a horizontal or vertical plane. Thus, the user may then utilize the drill with the knowledge that it is in a horizontal or vertical plane.

Turning to Figure 4, an additional embodiment of the present invention is shown. The elements that are the same are identified with the same reference numerals being primed.

The housing 50' includes a cylindrical cavity 52' for housing a rotating pendulum 54'. The pendulum 54' rotates on an axle 56'. The axle projects through a non-conductive shell 72'.

5 The pendulum 54' is a cylindrical body with a weighted portion 80 and external projecting members 82. The rotating pendulum member 54' is made from a conductive material. The weighting member 80 enables the rotating pendulum member 54' to seek an equilibrium position. The projecting members 82 extend from the cylindrical surface of the rotating pendulum member 54' to contact an electrical contact pin 84 in housing 50'. The contact pin 84 is coupled with a conductive leaf spring 86 which, in turn, is coupled with wire 32'. Also, the axle 56' is made from a
10 conductive material which, in turn, has its end coupled with wire 34'.

In use, the rotating pendulum member 54' rotates about the axle 56' in a three hundred sixty (360°) degree circle. When the drill is in a horizontal or vertical plane, a projecting member 82 contacts pin 84. Axle 56', which is already coupled with wire
15 34', enables completion of the circuit when the projecting members 82 contact the pin 84. Thus, the circuit is complete when the rotating pendulum member 54' is in a horizontal or vertical plane. This is the only time that the projections contact the pin which, in turn, complete the circuit, illuminating LEDs 38 and 40 indicating to the user that the drill is in a desired horizontal or vertical plane.

20 Turning to Figure 5, an additional embodiment of the present invention is shown. In Figure 5, like elements will be identified with like numerals being double primed.

The leveling indicator 30" includes a housing 50". The housing includes two parts 90 and 92. Inside the non-conductive housing parts 90 and 92 are conductive
25 cones 94 and 96. The conductive cones 94 and 96 are connected with wires 32" and 34" which, in turn, lead to the LEDs 38 and 40 as well as to battery 22". The rotating

members 54" include a pair of conductive balls. A membrane 100 is positioned between the cones 94 and 96. The membrane 100 includes apertures 102 which are positioned about an arc circle, ninety (90°) degrees apart.

5 When the level indicator 30" is utilized, the balls 54" rotate around the cones 94 and 96. The balls 54" seek an equilibrium position at the bottom of the cones when the drill is in a horizontal or vertical plane. When the drill is in a horizontal or vertical plane, the balls 54" are positioned in the cone wherein the balls, through apertures 102, contact one another. When the balls 54" contact one another, the conductive balls 54" are also in contact with the conductive cones 94 and 96, which complete the circuit, illuminating the LEDs 38 and 40. Thus, when the level indicator is in a horizontal or vertical position, the balls 54" contact one another through the apertures 102 in the membrane and complete the circuit.

15 While the above detailed description describes the preferred embodiment of the present invention, the invention is susceptible to modification, variation, and alteration without deviating from the scope and fair meaning of the subjoined claims.

What is Claimed is:

1. A mechanism to determine if a power tool is in a horizontal or vertical plane, comprising:

a housing, a cavity in said housing;

5 a rotating member in said housing, said rotating member moving in said cavity such that said rotating member seeks an equilibrium position which corresponds to a horizontal or vertical plane;

electrical contacts coupled with said rotating member, said electrical contacts only completing an electrical circuit when said rotating member is in said equilibrium position;

10 an indicator electrically coupled with said electrical contacts for indicating to a user when the mechanism is in an equilibrium position; and

a power source coupled with said electrical contacts and said indicator for energizing said indicator when said electrical circuit is complete.

2. The mechanism according to Claim 1, wherein said rotating member being fixed for rotation about a center axis in a cylindrical cavity in said housing.

3. The mechanism according to Claim 2, wherein said rotating member includes a biased electrical contact.

4. The mechanism according to Claim 2, wherein said electrical contacts being a pair of annular members coupled with said housing, each said annular member including electrical contact portions spaced ninety (90°) degrees from one another about a circle such that as said rotating member reaches said equilibrium position, said rotating member biased electrical member contacts said annular rings electrical contact portions completing the circuit and activating said indicator.

5. The mechanism according to Claim 2, wherein rotating member being manufactured from an electrically conducting material.

6. The mechanism according to Claim 5, wherein said rotating member being cylindrical with at least one projecting member.

7. The mechanism according to Claim 6, said electrical contacts including a biased member for electrically contacting said at least one projecting member when said cylindrical rotating member is in said equilibrium position and an axle at the center axis of said rotating member completing the circuit.

8. The mechanism according to Claim 1, said cavity defined by a pair of opposing conductive conical members acting as said electrical contacts.

9. The mechanism according to Claim 8, said rotating member comprising a pair of conductive balls.

10. The mechanism according to Claim 9, said opposing conductive conical members separated by a non-conductive membrane.

11. The mechanism according to Claim 10, wherein said membrane includes apertures positioned 90° , about a circle, apart from one another.

12. The mechanism according to Claim 11, wherein said balls contacts one another through said apertures when said balls are in said equilibrium position completing the circuit and activating said indicator.

13. A power tool comprising:

a housing;

a motor within said housing;

an output coupled with said motor;

5 an activation member for energizing said motor for rotating said output;

a power source electrically coupled with said motor and said activation member; and

a leveling mechanism comprising:

a housing coupled with said power tool housing;

10 a cavity in said housing;

a rotating member in said housing, said rotating member moving in said cavity such that said rotating member seeks an equilibrium position which corresponds to a horizontal or vertical plane;

electrical contacts coupled with said rotating member, said electrical contacts only completing an electrical circuit when said rotating member is in said equilibrium position;

15 an indicator electrically coupled with said electrical contacts for indicating to a user when the mechanism is in an equilibrium position; and

a power source coupled with said electrical contacts and said indicator

20 for energizing said indicator when the circuit is complete.

14. The power tool according to Claim 13, wherein said rotating member being fixed for rotation about a center axis in a cylindrical cavity in said housing.

15. The power tool according to Claim 14, wherein said rotating member includes a biased electrical contact.

16. The power tool according to Claim 14, wherein said electrical contacts being a pair of annular members coupled with said housing, each said annular member including electrical contact portions spaced ninety (90°) degrees from one another about a circle such that as said rotating member reaches said equilibrium position, said rotating member biased electrical member contacts said annular rings electrical contact portions completing the circuit and activating said indicator.

17. The power tool according to Claim 14, wherein rotating member being manufactured from an electrically conducting material.

18. The power tool according to Claim 17, wherein said rotating member being cylindrical with at least one projecting member.

19. The power tool according to Claim 18, said electrical contacts including a biased member for electrically contacting said at least one projecting member when said cylindrical rotating member is in said equilibrium position and an axle at the center axis of said rotating member completing the circuit.

20. The power tool according to Claim 13, said cavity defined by a pair of opposing conductive conical members acting as said electrical contacts.

21. The power tool according to Claim 20, said rotating member comprising a pair of conductive balls.

22. The power tool according to Claim 21, said opposing conductive conical members separated by a non-conductive membrane.

23. The power tool according to Claim 22, wherein said membrane includes apertures positioned 90° , about a circle, apart from one another.

24. The power tool according to Claim 23, wherein said balls contacts one another through said apertures when said balls are in said equilibrium position completing the circuit and activating said indication.

Abstract of the Disclosure

A power tool includes a leveling mechanism that determines horizontal or vertical planes of the power tool. The leveling mechanism has a housing with a cavity in the housing. A rotating member is in the housing. The rotating member moves in the cavity such that the rotating members seeks an equilibrium position. The equilibrium position corresponds to a horizontal or vertical plane. Electrical contacts are coupled with the rotating member such that the electrical contacts only complete an electrical circuit when the rotating member is in the equilibrium position. An indicator is electrically coupled with the electrical contacts to indicate to the user when the mechanism is in an equilibrium position. A power source is coupled with the electrical contacts and the indicator to energize the indicator when the circuit is complete.

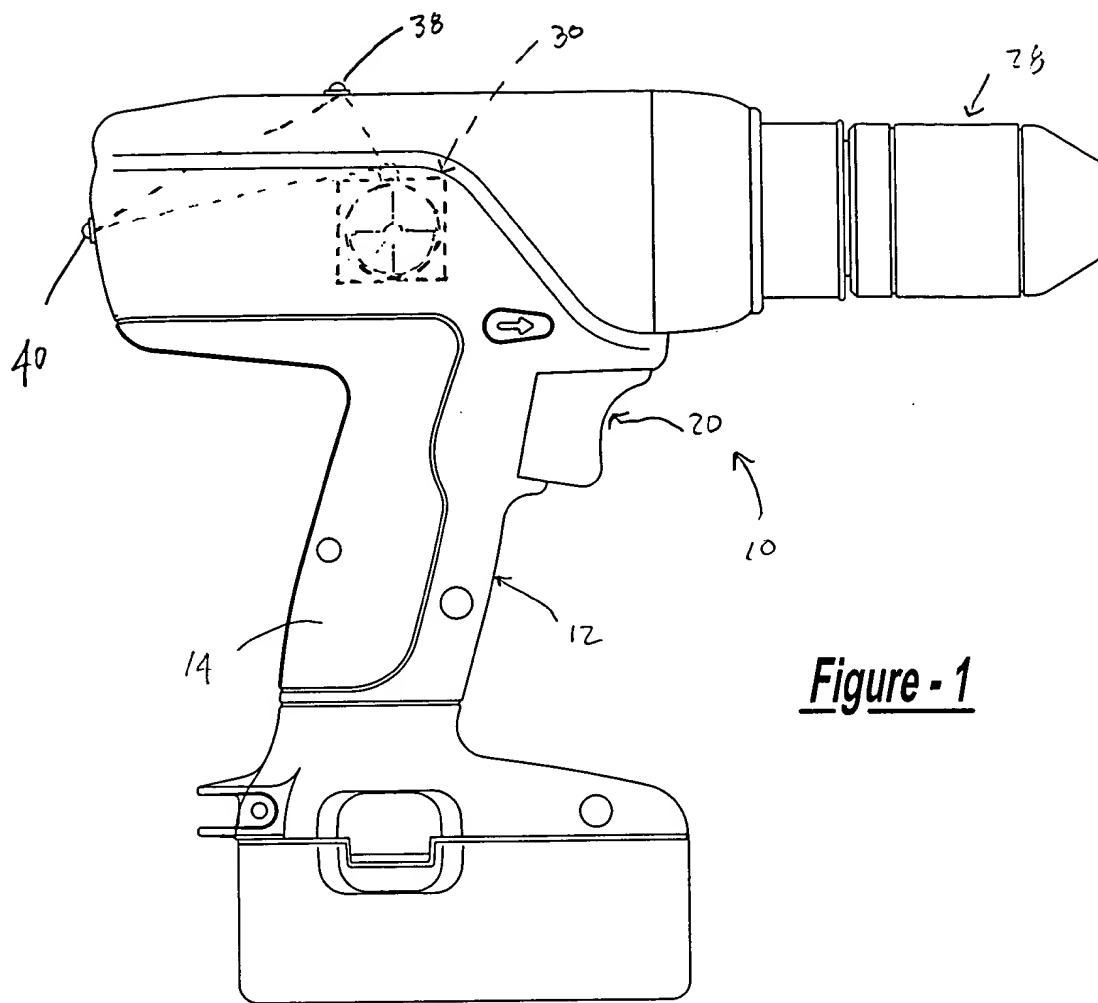


Figure - 1

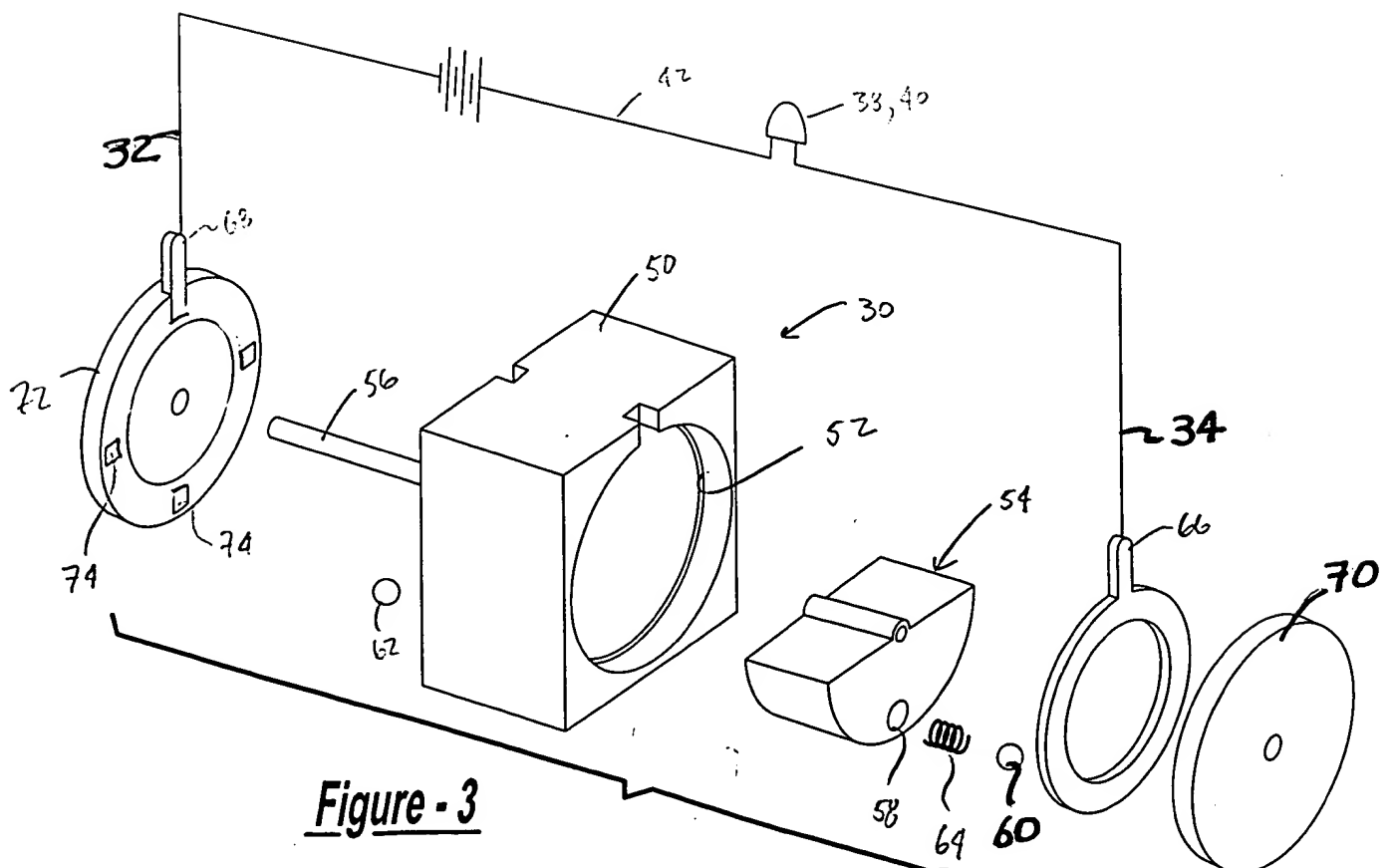


Figure - 3

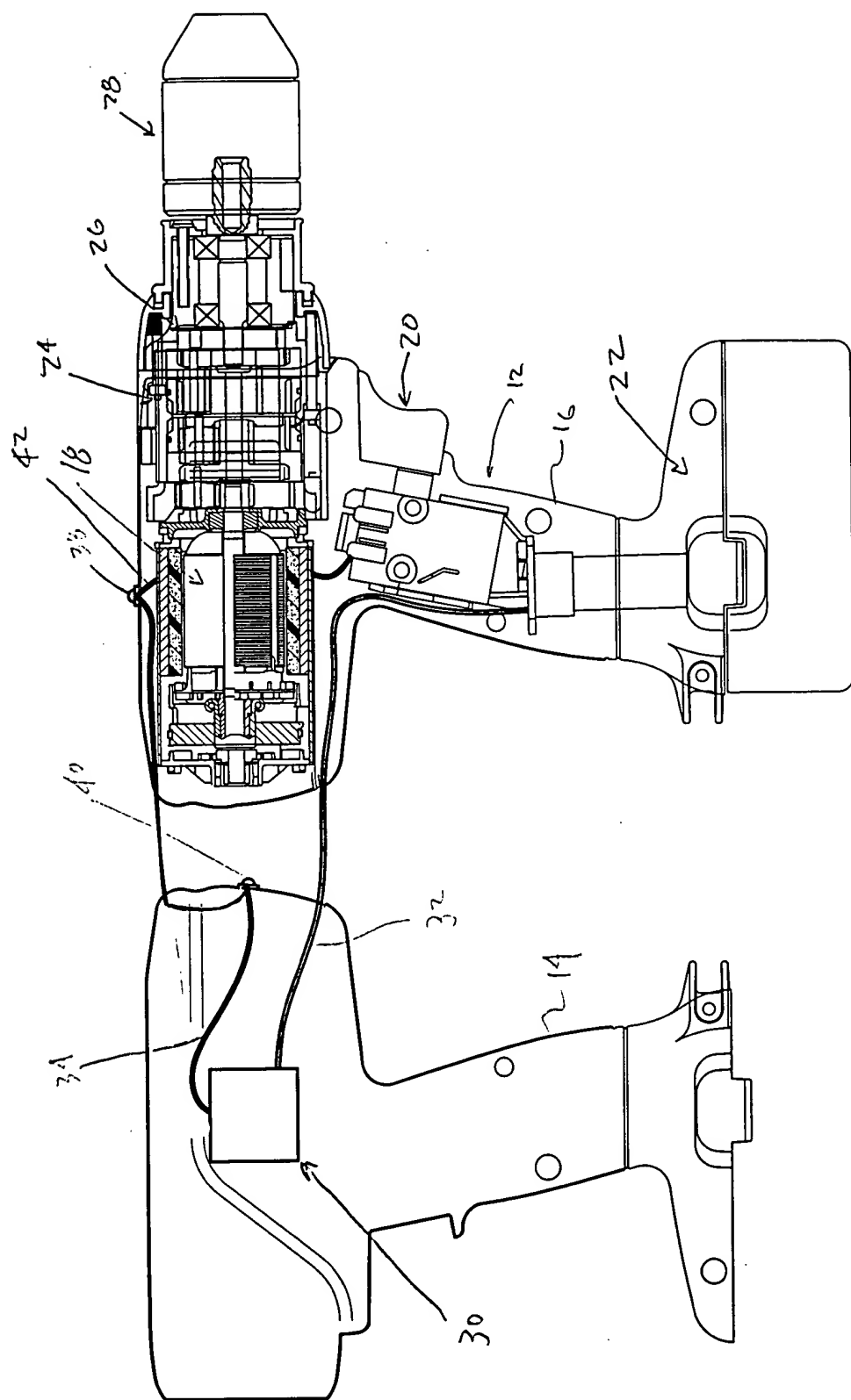


Figure - 2

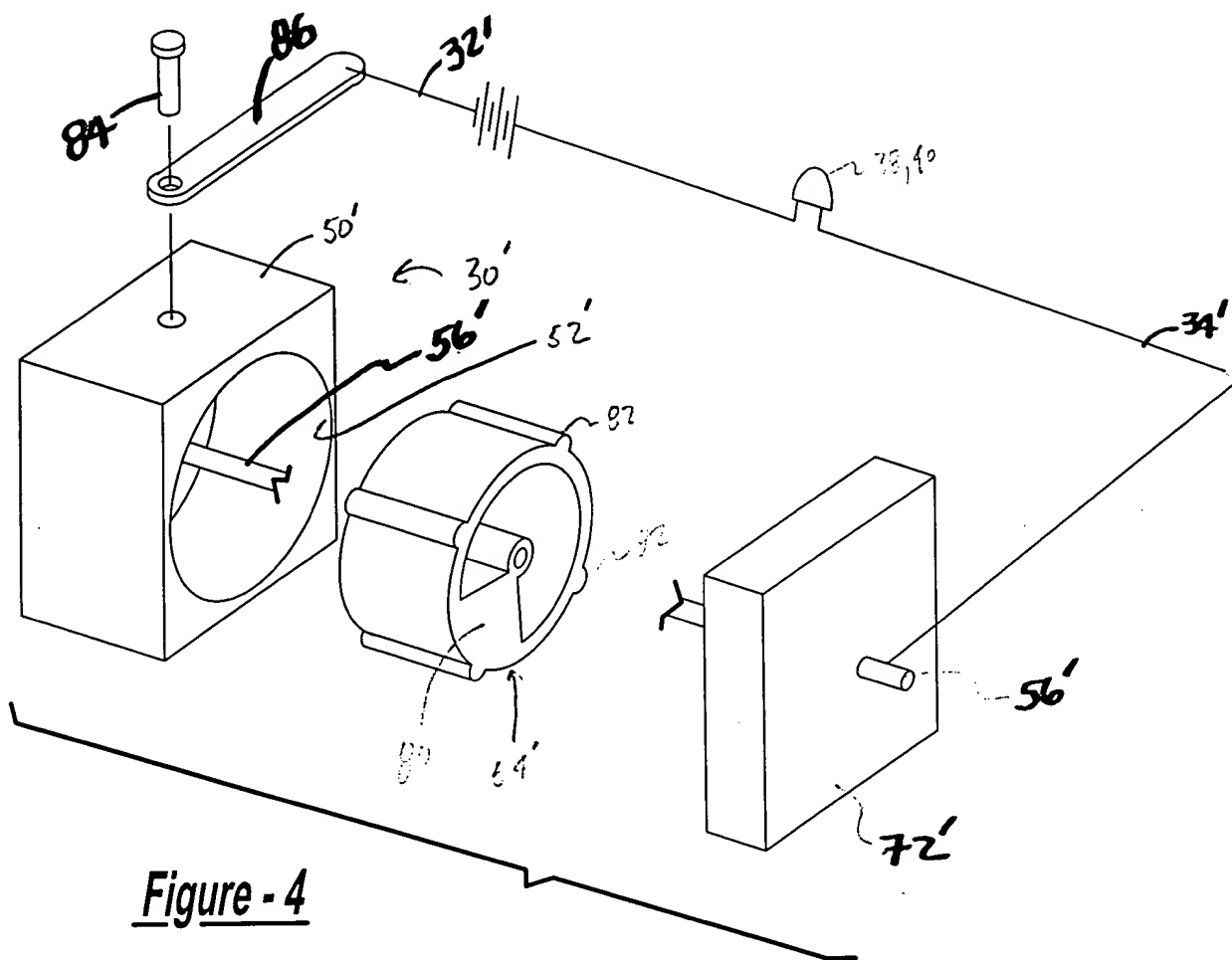


Figure - 4

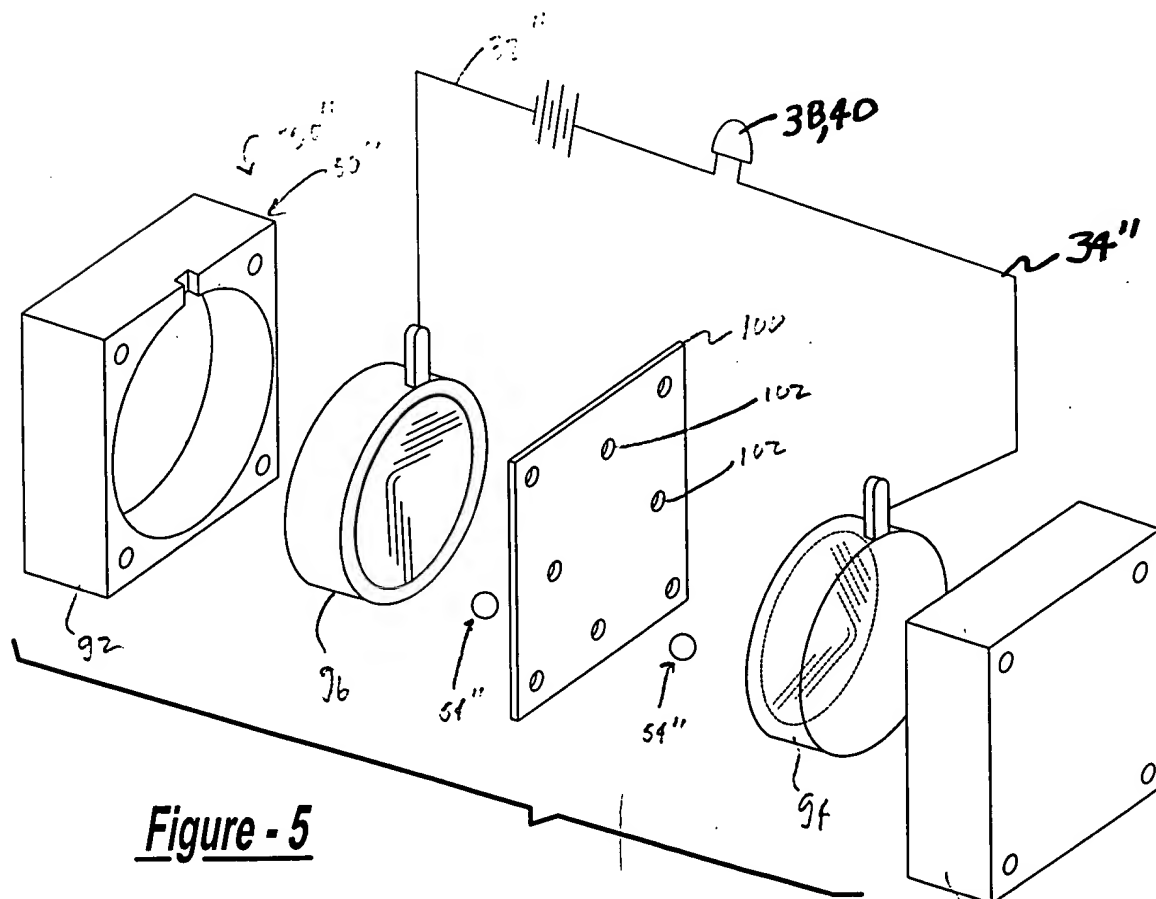


Figure - 5

[54] LEVEL INDICATING DEVICE

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[21] Appl. No.: 829,964

[22] Filed: Feb. 18, 1986

[51] Int. Cl.⁴ G01C 9/06

[52] U.S. Cl. 340/689; 33/366

[58] Field of Search 33/363 L, 366, 349,
33/312, 313, 308; 340/689

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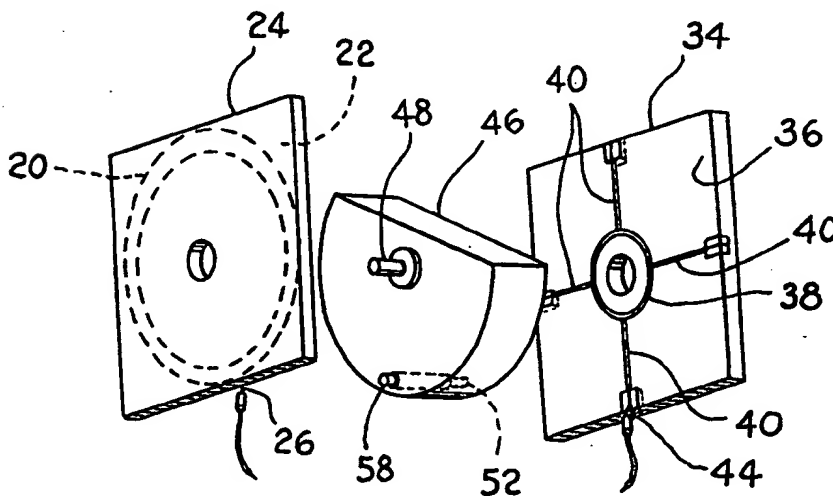
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[57] ABSTRACT

A level for emitting an audio-visual signal to indicate when the level attains a vertical or an horizontal condition includes an electric power supply, an electric buzzer, an electric light emitting device, a first printed circuit board having a ring of electrically conductive material thereon, a second printed circuit board having an electrically conductive cross pattern printed thereon, and a pendulum having an electrically conducting resilient biasing member to maintain contact between the first and second boards.

8 Claims, 4 Drawing Figures



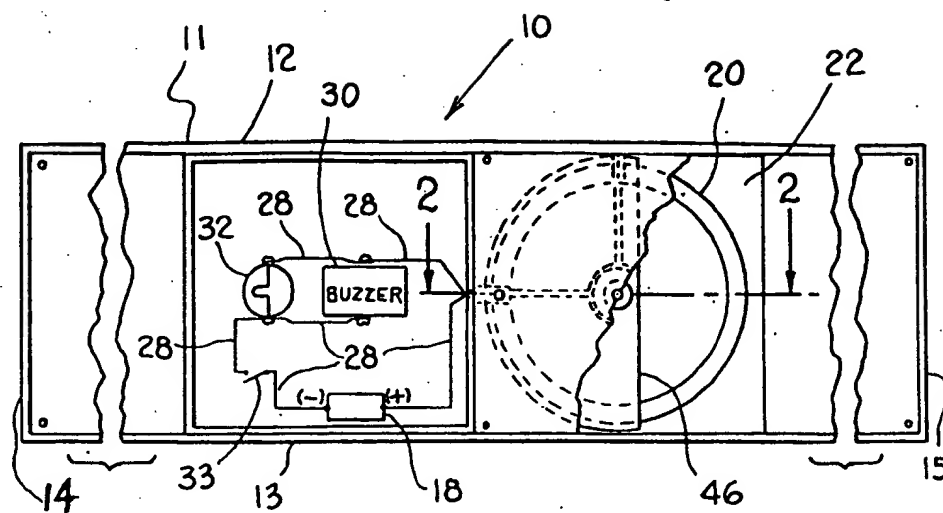


Fig. 1.

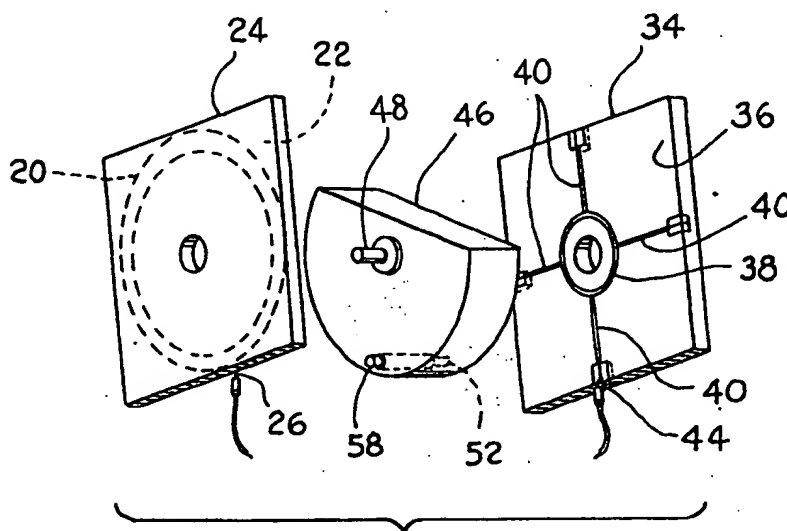
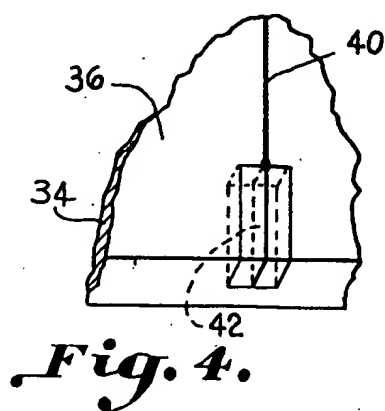
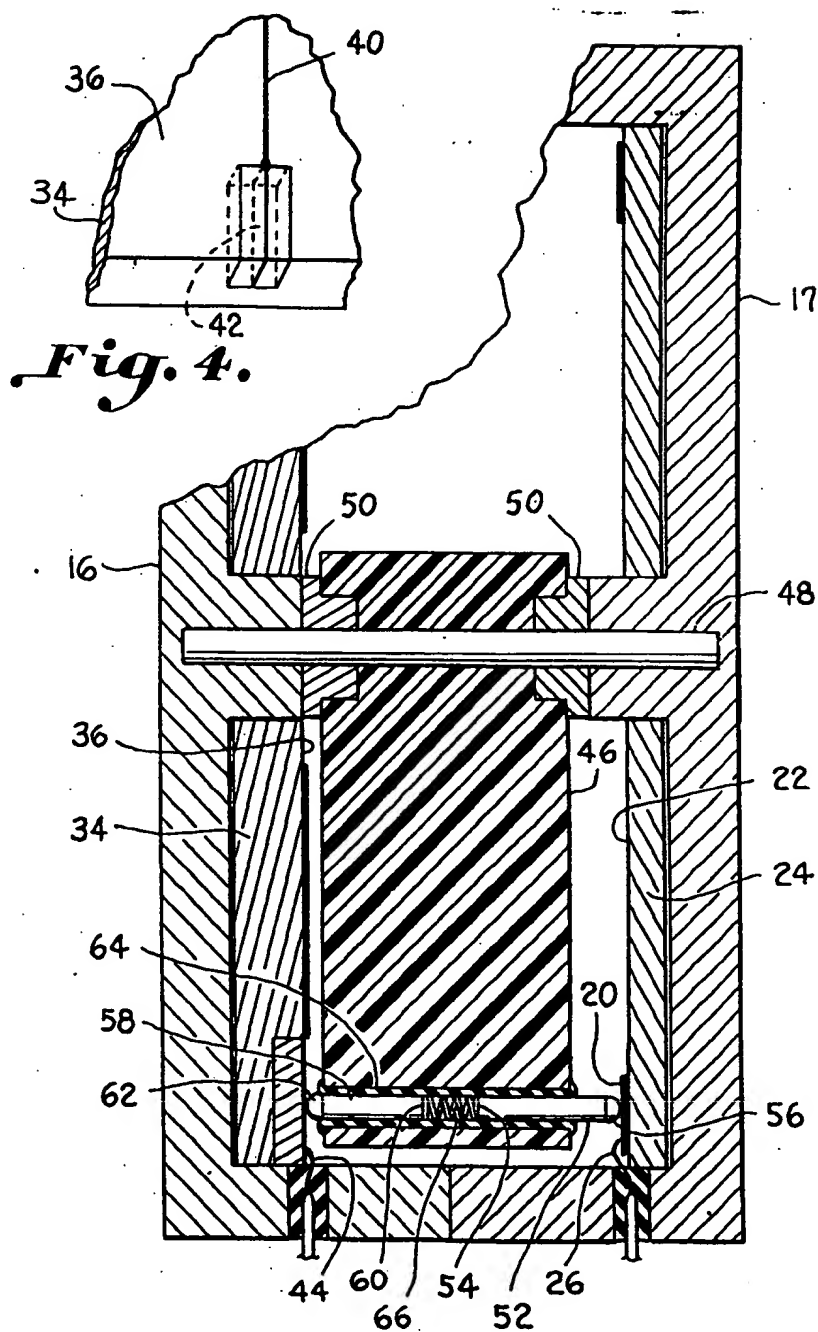


Fig. 3.



LEVEL INDICATING DEVICE

BACKGROUND OF THE INVENTION

The present invention relates to a level indicating device and specifically to a level which emits an audio signal and a visual signal when the desired level condition is attained by the device.

There are many instances where a solitary workman needs to adjust a workpiece to a level condition from a site remote from the place where the level condition is desired. In other instances, the level must be placed at a site that is not accessible to a person, and thus the observer of the level must remain at a location remote from the level's location. Moreover, the lighting conditions at the workplace are not always ideal for reading a conventional gas bubble type level. In such circumstances, a level indicating device which emits an audible signal or a visual signal upon attaining a level condition enables the workman to make the adjustment without requiring the presence of a second workman at the site where the level indicating device is placed to read when the level condition has been attained.

In U.S. Pat. No. 723,526 to Hein, a leveling staff has a pendulum which forms a complete electric circuit with an incandescent lamp and an electric bell when the pendulum is parallel to the longitudinal axis of the staff. U.S. Pat. No. 3,233,235 to Wright discloses a signaling level having a pendulum which magnetically activates a switch that closes a circuit and lights a light or sounds a buzzer when the level rests in an horizontal position. The pendulum is mounted on a rotatable, angularly adjustable dial which must be rotated depending upon whether the level is required to sense a vertical or an horizontal condition.

In some applications, it is desirable to have a level sensing device which is capable of sensing both an horizontal and a vertical condition either simultaneously or consecutively without any intervening adjustment of the device between sensing the vertical condition and sensing the horizontal condition.

OBJECTS AND SUMMARY OF THE INVENTION

It therefore is a principal object of the present invention to provide a device capable of detecting a truly horizontal or truly vertical condition and indicating same to a remote interested party, consecutively and without repositioning the device or resetting the device.

Additional objects and advantages of the invention will be set forth in part in the description which follows, and in part will be obvious from the description, or may be learned by practice of the invention. The objects and advantages of the invention may be realized and attained by means of the instrumentalities and combinations particularly pointed out in the appended claims.

To achieve the objects and in accordance with the purpose of the invention, as embodied and broadly described herein, the level indicating device of this invention comprises: a housing having at least one planar surface thereon; a source of electrical power received within the housing; a first, electrically conductive member received with the housing and in electrical communication with the source of power; a second member received within the housing in spaced apart relation to the first member; the second member having an electrically conductive surface on predetermined portions thereof only; a pendulum disposed between the

first and second members, the pendulum having electrical contact means on opposite sides of same with electrical connections therebetween, the contact means on one side of the pendulum making continuous contact with the first electrically conductive member; electrical signal means associated with the source of power, the first member and the electrically conductive surface portions of the second member; the electrical contact means in the opposite side of the pendulum making contact with one of the electrically conductive surface portions of the second member only when the housing is disposed to cause gravitational forces in the pendulum to locate the opposite side contact means at the predetermined electrically conducting surface portion of the second member; and whereby when the housing is disposed to cause gravitational forces on the pendulum to locate the opposite side contact means of the pendulum at the electrically conductive surface of the second member, the electrical signal means, the source of electrical power, the first member, the electrical contact means of the pendulum, and the electrically conductive surface of the second member are electrically connected to activate the signal means.

The device of the present invention is not limited to detecting just a vertical position or just a horizontal position. It does not need to be manually preset before it can detect a vertical condition as opposed to a horizontal condition. Rather, the device is always capable of detecting a predetermined orientation of the device relative to the direction of the force of gravity on the device, without being preset to detect specifically one or the other.

The electrical signal means of the invention can include both audible signaling means and visible signaling means. An electric buzzer constitutes one example of suitable audible signaling means, and a light emitting diode (LED) or an incandescent lamp constitute examples of suitable visible signaling means.

One embodiment of the first, electrically conductive member includes a printed semiconductor circuit board having a ring of conductive material formed on a planar surface thereof. Similarly, an example of the second member, which is received within the housing in spaced apart relation to the first member, is a semiconductor printed circuit board having a pattern of predetermined geometry of conductive material formed on a planar surface thereof. The predetermined geometry can include linear projections with adjacent ones of these linear projections extending relative to one another at any desired predetermined angle, such as 30°, 45° or 90°.

An embodiment of the electrical contact means comprises a resilient biasing means formed of electrically conducting material, a continuous contact member electrically contacting the biasing means and the continuous conductive ring of the first printed circuit board, an intermittent contact member electrically communicating with the biasing means and physically contacting the second printed circuit board. The biasing means maintains continuous contact between the first member and the first board and between the second member and the second board as the pendulum swings in the space between the two boards, and accordingly, electrical communication is established between the second member and one of the linear projections comprising the geometrical pattern on the second board as the level is supported for, example, in one of horizontal and vertical positions.

A metal spring comprises one embodiment of the resilient biasing means.

One embodiment of the invention has an activation means, which includes a first printed circuit board having a ring of conductive material formed thereon, a second printed circuit board having a cross pattern of conductive material formed thereon, and a pendulum having contact means for electrically connecting the ring of the first board with the cross pattern of the second board. The pendulum is rotatably mounted between the first and second printed circuit boards and is free to swing 360° in a circle.

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate one embodiment of the invention and, together with the description, serve to explain the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front plan view, with cut-away and phantom portions, of an embodiment of the present invention;

FIG. 2 is a cross-sectional view taken along the line indicated by the numerals 2—2 of FIG. 1;

FIG. 3 is a perspective exploded view of components of an embodiment of the present invention; and

FIG. 4 is an expanded partial view of a component of an embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the present preferred embodiment of the invention, an example of which is illustrated in the accompanying drawings.

The present invention is a level indicating device that indicates to a remote interested party, when the device has attained a predetermined angular orientation relative to the direction of the force of gravity, and preferably a vertical or a horizontal orientation. The invention comprises a housing, an electric power supply, audible signaling means, visible signaling means, and means for electrically connecting the power supply, the audible signaling means and the visible signaling means when the level attains one of vertical and horizontal positions. One embodiment of the present invention is depicted in FIG. 1 and is generally designated by the numeral 10.

One embodiment of the device of the present invention includes a housing 11 which may be formed in the shape of a rectangular box having six planar sides, including a pair of horizontal sides 12, 13, a pair of vertical sides 14, 15, a front end 16 and a back end 17 (FIG. 2). As shown in FIG. 1 for example, horizontal sides 12, 13 are oriented at a predetermined angle of 90° relative to vertical sides 14, 15. However, other shapes can be formed to provide planar surfaces oriented relative to one another at an angle other than 90°. For example, two planar surfaces can be oriented at an angle of 45°, 30°, etc. In this way, the device of the present invention can be used to indicate different angular orientations relative to the direction of the force of gravity on the pendulum (to be described below). The housing can be formed of any suitable material, such as wood, sheet metal, plastic, etc., and can be made water proof and dust proof by the application of appropriate sealing substances or structures.

The source electrical power of the present invention can comprise a portable direct current electric power supply, such as is furnished by a battery 18. The voltage

output requirement of the battery will depend upon the requirements of the devices used to provide the audible and visible signals of the device. However, a 9-volt battery normally used to power portable radios and cassette tape players is generally deemed adequate for purposes of the present invention.

In accordance with the present invention, a first, electrically conductive member is provided to be received within the housing and in electrical communication with the source of electrical power. As embodied herein and shown for example in phantom in FIG. 3, in a front partial plan view in FIG. 1, and in a cross-sectional view in FIG. 2, the first member comprises a ring 20 of electrically conductive material, such as copper or other metal, formed on a substantially planar surface 22 of a main body of a first printed circuit board 24, which may be formed of an insulating material or of a semiconductor material. Ring 20 need not be substantially planar, but could have a definite contour. Circuit board 24 is formed with an opening therethrough in the central region thereof, and ring 20 of conductive material can be deposited thereon by any of the methods familiar to those who manufacture semiconductor electronic devices. First printed circuit board 24 is mounted within housing 11 as by screws, glue or other fastening means. As shown particularly in FIG. 2, a lead wire 26 electrically connects conductive ring 20 of first printed circuit board 24 to the electrical circuit comprising a plurality of wires 28, the power supply, an electric buzzer 30, an incandescent lamp 32, and an on/off switch 33.

In further accordance with the present invention, a second member is provided to be received within the housing in spaced apart relation to the first member. An electrically conductive surface is provided on predetermined portions only of the second member in accordance with the invention. As embodied herein and shown in FIG. 3 in exploded view, FIG. 1 in phantom view, and FIG. 2 in a cross-sectional view, the second member comprises a second printed circuit board 34 which has a substantially planar surface 36. A continuous, electrically conductive, geometrical pattern 38 is formed of conductive material, such as copper or aluminum, on surface 36. In the embodiment shown in FIG. 3, there are a plurality of electrically conductive peripheral portions 40 forming part of the continuous pattern which is deposited on second board 34 in a manner familiar to those skilled in the production of electronic semiconductor devices. The pattern of electrically conductive material formed on second board 34 can have a generally cross-shaped appearance of four radially extending linear projective portions 40, which are oriented at 90° intervals between adjacent projective portions 40, as shown in FIG. 3. Circuit board 34 is formed with an opening therethrough in the central region thereof. The central portion of pattern 38 comprises a circular ring of conductive material surrounding the opening, and from which each of the four linear projective portions extend radially outwardly toward the peripheral edge of the main body of second circuit board 34.

Continuous pattern 38 also can be formed with adjacent linear projective portions 40 oriented at angles other than 90°, such as at angles of 30°, 45°, etc. Second board 34 is mounted inside housing 11 as by screws, glue or other fastening means. The orientation of any of electrically conductive surface portions 40 can be predetermined relative to the orientation of one of the planar surfaces of housing 11. As will become clear

from the description which follows, in accordance with such predetermined relative orientation of a planar housing surface and an electrically conductive surface portion of the second member, the device of the present invention can be made to indicate when the device is resting at an angle of 90°, or an angle other than 90°, from the direction along which the gravitational force acts on the pendulum (described below) of the device.

The portion of each electrically conductive portion 40 of pattern 38 of second circuit board 34 nearest the peripheral edge of board 34 is shown in expanded detail in FIG. 4. This end section of each electrically conductive portion comprises a razor thin foil 42 of electrically conductive material which connects to each portion 40 at the end thereof nearest the peripheral edge of board 34. Foil 42 is sandwiched between two layers of semi-conductive substrate, or other nonconductive material, and inserted into second board 34 as shown in FIG. 4, and honed and polished smooth with planar surface 36 of board 34. These end sections of portions 40 provide very precise points of electrical contact due to the very narrowly defined regions occupied by foils 42.

As shown in particular in FIGS. 2 and 3, one of the four razor thin foils 42 is electrically connected to an electrical lead wire 44 which forms part of an electrical circuit with wires 28, the power supply, buzzer 30, and lamp 32. Lead wire 44 electrically connects conductive pattern 38 of second printed circuit board 34, including each of razor thin foil sections 42 at the extreme ends of each of four projective portions 40, to the circuit elements comprising the power supply, the audible signaling means, and the visible signaling means.

The device of the present invention also includes a pendulum disposed between the first and second members and having electrical contact means on opposite sides of the pendulum. As embodied herein, a pendulum 46 is mounted as shown in FIG. 2 about a cylindrical shaft 48, which has each end anchored in watertight and dustproof housing 11 of the device. Shaft 48 extends through pendulum 46, and a pair of bearings 50 pivotally support pendulum 46, which rotates 360° in a circular path around shaft 48. Pendulum 46 is mounted to swing freely in the space that exists between first board 24 and second board 34. Each of planar surfaces 22, 36 of boards 24, 34, respectively, faces pendulum 46, which is preferably formed of any suitable dense material, such as lead. Moreover, the material forming pendulum 46 can be either electrically conducting or non-conducting as desired. However, if electrically conducting material is chosen, it becomes necessary to insulate the electrical contact means described below.

In further accordance with the present invention, the pendulum is provided with electrical contact means on opposite sides of the pendulum and with electrical connections therebetween. The invention also provides that the electrical contact means on one side of the pendulum makes continuous electrical contact with the first electrically conductive member and further that the electrical contact means on the opposite side of the pendulum makes electrical contact with the electrically conductive surface at one of the predetermined electrically conductive surface portions of the second member, only when the housing is disposed to cause gravitational forces acting on the pendulum to locate the opposite side contact means at one of the predetermined electrically conductive surface portions of the second member. As embodied herein and shown for example in FIGS. 2 and 3, the electrical contact means of the pres-

ent invention includes a resilient biasing means formed of electrically conducting material. The electrical contact means further includes a continuous contact member 52 having an inner end 54 contacting one end of the biasing means and having an outer end 56 in continuous electrical communication with conductive ring 20 of first board 24. Continuous contact member 52 can be formed solely of an electrically conducting material, or of a non-conducting material surrounding an electrically conducting element which is connected to ends 54, 56, which are themselves formed of electrically conducting material. The electrical contact means still further includes an intermittent contact member 58 having an inner end 60 contacting the opposite end of the biasing means and having an outer end 62 physically contacting first planar surface 36 of second printed circuit board 34. Intermittent contact member 58 also can be formed of either electrically conducting material throughout or of non-conducting material surrounding an electrically conducting element connected to its ends 60, 62, which are themselves formed of electrically conducting material.

In the embodiment shown in cross-section in the view of FIG. 2, a cylindrical sleeve 64 formed of electrically insulating material surrounds the biasing means and continuous and intermittent contact members 52, 58, which are formed of electrically conducting material throughout. Inner and outer ends 54, 56 are integrally formed as part of continuous contact member 52, and inner and outer ends 60, 62 are integrally formed as part of intermittent contact member 58. Insulating sleeve 64 electrically insulates the biasing means and continuous and intermittent contact members 52, 58 from pendulum 46, which can be formed of a dense metallic material.

In still further accordance with the present invention, resilient biasing means formed of electrically conducting material is provided for maintaining continuous electrical communication between the continuous contact member and the first, electrically conductive member and for maintaining continuous physical contact between the intermittent contact member and the second member as the pendulum swings in the space between the first and second members and electrical communication is established between the intermittent contact member and one of the electrically conductive portions of the second member, as the device is supported for example in one of horizontal and vertical positions. As embodied herein and shown for example in FIG. 2, the resilient biasing means of the present invention preferably comprises a metallic spring 66, which is inserted between and electrically communicates with inner ends 54, 60, respectively, of continuous and intermittent contact members 52, 58.

In accordance with the present invention, electrical signal means are provided, such as audible signaling means or visible signaling means. For example, as shown in FIG. 1, an embodiment of the audible signaling means of the present invention comprises an electric buzzer 30 which emits a buzzing sound when an electric current flows therethrough.

A visible signaling means is provided in further accordance with the present invention. One embodiment of the visible signaling means of the present invention comprises an incandescent electric lamp 32, as shown for example in FIG. 1. A light emitting diode (LED) (not shown) also provides a suitable visible signaling means in accordance with the present invention.

In still further accordance with an embodiment of the present invention, activation means are provided for electrically connecting the electric power supply, the audible signaling means and the visible signaling means when the device attains one of vertical and horizontal positions. As embodied herein and shown for example in FIGS. 1-3, the activation means comprises a plurality of electric current carrying elements, such as wires 28, a pendulum 46 having an electrical contact means, a first printed circuit board 24, a second printed circuit board 34, and wherein the power supply, audible signaling means, visible signaling means, the contact means, first board 24 and second board 34 form a complete electrical circuit when the device of the present invention attains for example one of horizontal and vertical positions.

In operation, one of the exterior surfaces, such as horizontal surfaces 12, 13 or vertical surfaces 14, 15 of housing 11 is placed against a surface which the operator of device 10 desires to monitor. For example, the operator can place the device at one end of a plank while raising or lowering the opposite end of the same plank at a considerable distance to the end where the device is resting. Assuming for purposes of this discussion that a vertical surface 14 (FIG. 1) is the surface resting against this hypothetical plank, pendulum 46 is free to rotate as the gravitational force acts on pendulum 46 and orients same according to the orientation of pendulum 46 relative to the source of the gravitational attraction and vertical surface 14. As pendulum 46 rotates, continuous contact member 52 continuously electrically communicates with conductive ring 20 of first printed circuit board 24 while intermittent contact member 58 continuously physically contacts first planar surface 36 of second printed circuit board 34. However, second printed circuit board 34 is oriented relative to vertical surfaces 14, 15 and horizontal surfaces 12, 13 such that when either of the exterior vertical or horizontal surfaces of housing 11 rests against a level surface, one of four razor thin foil portions 42 of one of four linear projective portions 40 of conductive cross pattern 38 of second printed circuit board 34, becomes precisely aligned with outer end 62 of intermittent contact member 58 of the electrical contact means carried by pendulum 46. This precise condition is shown in each of FIGS. 1 and 2. When this condition has been attained, a complete electrical circuit is formed, assuming an on/off switch 33 is closed, between the power supply, buzzer 30, and lamp 32. The attainment of this condition activates buzzer 30 and lamp 32 to sound and light respectively, and accordingly indicates to the operator, who is located at a position remote from the device, that the desired level condition has been attained.

Moreover, the device of the present invention operates regardless of whether it is one of vertical exterior surfaces 14, 15 or horizontal exterior surfaces 12, 13, that is resting against the surface to be monitored by the operator. In other words, the device of the present invention is capable of indicating both a horizontal or a vertical condition of the device without requiring any adjustment of the device, such as the manual adjustment of the dial required of the device disclosed in Wright (U.S. Pat. No. 3,233,235) discussed above.

It will be apparent to those skilled in the art that various modifications and variations can be made in the level indicating device of the present invention, without departing from the scope of spirit of the invention.

Thus, it is intended that the present invention cover the modifications and variations of this invention, provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A device for indicating to a remote interested party, when the device attains a predetermined orientation relative to the direction of the force of gravity on the device, comprising:

- a housing having at least one planar surface thereon;
- a source of electrical power received within said housing;
- a first, electrically conductive member received within said housing and in electrical communication with said source of power;
- a second member received within said housing in spaced apart relation to said first member, said second member having an electrically conductive surface on predetermined portions only;
- a pendulum disposed between said first and second members, said pendulum having electrical contact means on opposite sides of same with electrical connections therebetween, said electrical contact means on one side of said pendulum making continuous electrical contact with said first electrically conductive member;

electrical signal means associated with said source of electrical power, said first member and one of said electrically conductive surface portions of said second member;

said electrical contact means on said opposite side of said pendulum electrically communicating with one of said electrically conductive surface portions of said second member only when said housing is disposed to cause gravitational forces acting on said pendulum to locate said opposite side contact means at said predetermined electrically conducting surface portion of said second member; and whereby when said housing is disposed to cause gravitational forces on said pendulum to locate said opposite side contact means of said pendulum at one of said electrically conductive surface portions of said second member, said electrical signal means, said source of electrical power, said first member, said electrical contact means of said pendulum, and said electrically conductive surface of said second member are electrically connected to activate said signal means.

2. A device as in claim 1, wherein:

- each of said first and second members includes a printed circuit board;
- said electrical signal means includes an audible signaling means and a visible signaling means;
- said power source, said audible signaling means, said visible signaling means, said contact means, said first and second members forming a complete electrical circuit when one of said planar surfaces of said housing attains said predetermined orientation relative to the direction of the force of gravity on the device.

3. A device for emitting audio-visual signals upon attaining a predetermined orientation relative to the direction of the force of gravity on the device, the device comprising:

- an electronic circuit including a power supply, an audible signaling means, a visible signaling means and an activation means;

said activation means including a first printed circuit board having a first planar surface and printed thereon around the periphery thereof a continuous ring of conductive material, a second printed circuit board having a first planar surface and printed thereon a continuous pattern of conductive material with at least two projections, adjacent ones of said projections being oriented relative to each other at a predetermined angle, and a pendulum having electrical contact means for electrically connecting said continuous ring and one of said projections to activate said audible signaling means and said visible signaling means when the device rests against a surface disposed at a predetermined orientation relative to the direction of the force of gravity.

4. An audio-visual signaling device as in claim 3, wherein:

said first and second boards are spaced apart from each other and said pendulum is mounted to swing freely and is disposed in the space between said first board and said second board, and each of said planar surfaces of said boards faces said pendulum.

5. An audio-visual signaling device as in claim 4, wherein:

said electrical contact means of said pendulum includes a resilient biasing means formed of electrically conducting material, a continuous contact member electrically communicating with said conductive ring of said first board and with said biasing means, an intermittent contact member electrically communicating with said biasing means and physically contacting said second board; and

whereby said biasing means maintains continuous contact between said continuous contact member and said first board and between said intermittent contact member and said second board as said pendulum swings in the space between said boards and electrical contact is established between said intermittent contact member and one of said projections of said second member as the device is supported at said predetermined orientation relative to the direction of the force of gravity on the device.

6. An audio-visual signaling device as in claim 5, wherein: each of said projection portions of said continuous pattern of conductive material printed on said second printed circuit board has at the peripheral edge thereof a razor thin foil portion of conducting material for providing precise electrical contact with said intermittent contact member when the device has attained one said predetermined orientation relative to the direction of the force of gravity on the device.

7. A device for indicating to a remote interested party, when the device attains a predetermined orientation relative to the direction of the force of gravity on the device, comprising:

a housing having at least two planar surfaces thereon and oriented at a predetermined angle relative to each other;

a source of electrical power received within said housing;

a first, electrically conductive member received within said housing and in electrical communication with said source of power;

a second member received within said housing in spaced apart relation to said first member, said second member having an electrically conductive surface on predetermined portions only;

a pendulum disposed between said first and second members, said pendulum having electrical contact means on opposite sides of same with electrical connections therebetween, said electrical contact means on one side of said pendulum making continuous electrical contact with said first electrically conductive member;

electrical signal means associated with said source of electrical power, said first member and one of said electrically conductive surface portions of said second member;

whereby when said housing is resting on one of said planar surfaces, said contact means in said opposite side of said pendulum electrically communicates with said electrically conductive surface at one of said predetermined portions of said second member, as gravitational forces acting on said pendulum locate said opposite side contact means at said predetermined electrically conducting surface portion of said second member; and

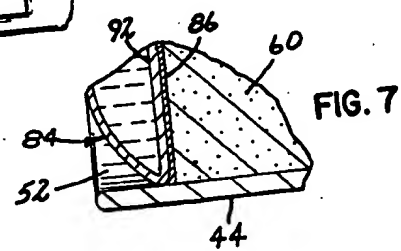
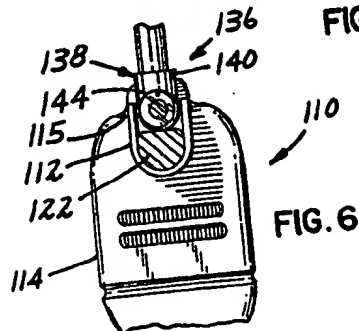
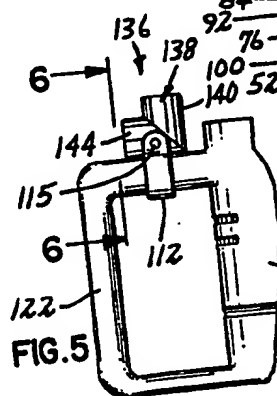
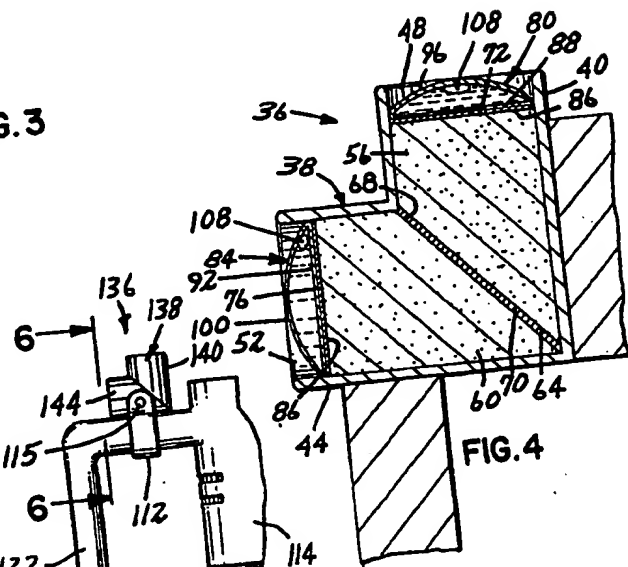
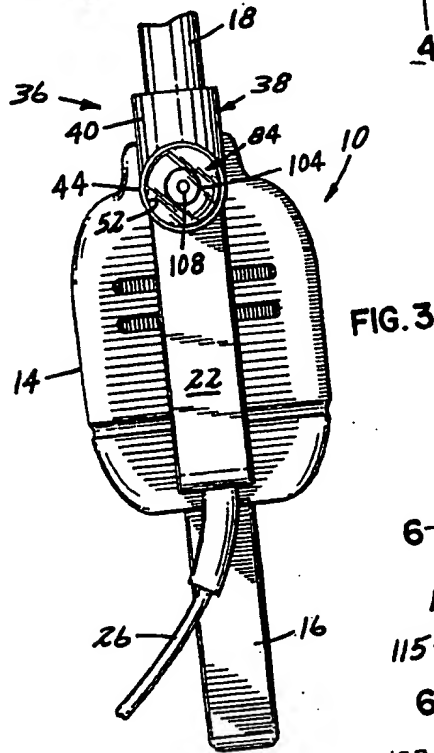
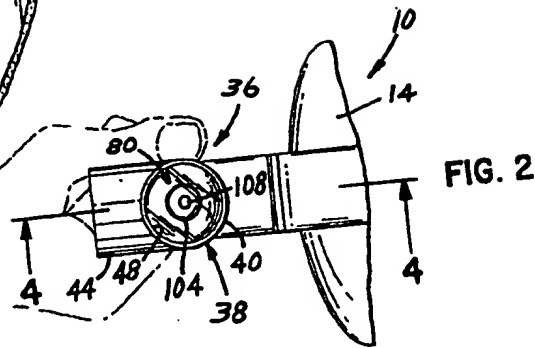
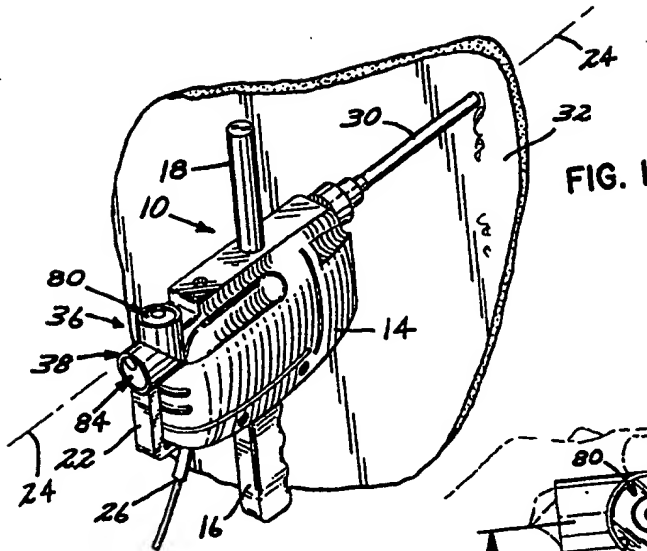
whereby when said housing is disposed to cause gravitational forces on said pendulum to locate said opposite side contact means of said pendulum at said electrically conductive surface of said second member, said electrical signal means, said source of electrical power, said first member, said electrical contact means of said pendulum, and said electrically conductive surface portion of said second member, are electrically connected to activate said signal means.

8. The device of claim 7, wherein:

said electrically conductive surface of said second member includes at least one razor thin foil portion of conducting material for providing precise electrical communication with said contact means on said opposite side of said pendulum.

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[45] Feb. 27, 1979



DRILL LEVELING ARRANGEMENT

BACKGROUND OF THE INVENTION

This invention relates to the general field of mechanical tools. More particularly, this invention relates to a leveling device for use in conjunction with a portable power tool.

It is often important in the use of power tools, such as electric drills, that the working or drill axis be properly aligned horizontally or vertically. Usually, visual alignment is insufficient and inaccurate for this purpose. However, the employment of a separate leveling device, such as a carpenter's level, to properly align the working axis is usually extremely cumbersome. Also, the use of a separate level is inconvenient where it is required that both hands be employed to operate the power tool.

SUMMARY OF THE INVENTION

The invention comprises an improved leveling device for incorporation into or use as an accessory to a power tool having a working axis. The leveling device generally comprises a plurality of bubble levels and means for mounting one of the levels so as to indicate deviation from the horizontal of a first datum plane and one of the levels so as to indicate deviation from the horizontal of a second datum plane perpendicular to the first datum plane. The leveling device is associated with the power tool so that one of the levels indicates deviation of the working axis from the horizontal and so that the other level indicates deviation of the working axis from the vertical.

Various advantages and features of novelty which characterize my invention are pointed out with particularity in the claims annexed hereto and forming a part hereof. However, for a better understanding of the invention, its advantages, and objects attained by its use, reference should be had to the drawing which forms a further part hereof, and to the accompanying descriptive matter, in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a portable electric drill horizontally oriented and having incorporated therein a first embodiment of the invention;

FIG. 2 is a fragmentary plan top view of the structure of FIG. 1;

FIG. 3 is an end view of the structure of FIG. 1 oriented along a vertical axis;

FIG. 4 is a fragmentary sectional view taken along line 4-4 of FIG. 2;

FIG. 5 shows a second embodiment of the invention in which an independent leveling device is configured for attachment to the rear handle of a portable electric drill;

FIG. 6 is a fragmentary sectional view taken along line 6-6 of FIG. 5; and

FIG. 7 is an enlarged fragmentary view of a portion of FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, FIG. 1 shows a power tool such as a portable electric drill 10 which has a main drill casing 14, a bottom finger grip handle 16, a top cylindrical handle 18, and a U-shaped rear handle 22.

The working axis of drill 10 is indicated at 24. Drill 10 also has an electric cord 26 and a drill bit 30 which rotates about axis 24.

Incorporated in the handle 22 is a leveling device 36 which is more fully shown in FIG. 4. A portion of handle 22 has been replaced by the housing 38 of leveling device 36, which is integral with casing 14. Leveling device 36 has the configuration of two hollow cylindrical members 40, 44 joined at right angles to form a right angle elbow. The cylindrical members have circular open ends 48, 52 respectively which define mutually perpendicular planes. This right angle elbow is positioned in handle 22 so that the longitudinal axis of cylindrical member 44 is aligned with drill axis 24.

Leveling device 36 further includes a pair of cylindrical plugs 56, 60 which are made out of a suitable resilient material such as cork. The plugs have beveled ends 64, 68 respectively, and are positioned within the cylindrical members so that the beveled ends are in planar contact and are secured to each other by suitable means such as cement 70. The plugs have circular planar free ends 72, 76 respectively, which are displaced parallel to and within the planes defined by the open ends of the cylindrical members.

Leveling device 36 further includes a pair of circular bubble levels 80, 84. The bubble levels have planar circular bases 88, 92 respectively, which are secured to the free ends of the plugs by suitable means such as cement 86 so as to define mutually perpendicular planes. The bubble levels also have curved upper portions 96, 100 respectively, the outermost parts of the upper portions being generally tangential with respect to the planes defined by the respective open ends of the cylindrical members.

As shown in FIG. 2, each bubble level also includes a centering circle 104 slightly larger than a bubble 108 in the liquid enclosed within the level. The centering circle 104 is positioned on the upper portion of the level and is concentric with the base of the level.

In operation, bubble level 80 is used to insure the horizontal alignment of drill axis 24 when the drill is being used to make a horizontal hole. For example, if the outer end of the drill has been raised too high above the horizontal, bubble 108 moves toward the user of the drill. If the outer end of the drill is too low, bubble 108 moves away from the user of the drill. By positioning the drill so that the bubble 108 is within the centering circle 104, the drill axis 24 becomes horizontally aligned.

In contrast, bubble level 84 is used when the drill axis is to be aligned vertically to drill a vertical hole. If the drill is tilted away from the vertical, bubble 108 will move left or right or forward or backwards out of centering circle 104. To align the drill vertically, the drill is moved until bubble 108 is once again within centering circle 104.

In a second embodiment of the invention for use with drill 110 is shown in FIGS. 5 and 6. In this embodiment, an independent leveling device 136 may be secured to the upper portion of unmodified drill handle 122 extending from casing 114 by means of a U-shaped bracket 112 which has a retention bolt 115 running through a housing 138 configured as an elbow, having two intersecting cylindrical members 140 and 144. As before, the longitudinal axis of cylindrical member 144 is aligned with the drill axis. The operation of leveling device 136 is the same as that detailed with respect to leveling device 36.

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From the foregoing description, it can be seen that applicant has invented a new and useful device for indicating deviation of a drill axis from either horizontal or vertical alignment.

Numerous characteristics and advantages of my invention have been set forth in the foregoing description, together with details of the structure and function of the invention, and the novel features thereof are pointed out in the appended claims. The disclosure, however, is illustrative only, and changes may be made in detail especially in matters of shape, size, and arrangement of parts, within the principle of the invention, to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

I claim:

1. A leveling device comprising:

an elbow having hollow cylindrical members joined to each other at right angles, said cylindrical members having circular open ends defining mutually perpendicular planes;

a pair of resilient cylindrical plugs, one of said plugs being positioned within each of said cylindrical members, each of said plugs having a beveled end and a circular planar free end displaced from said open end of one of said cylindrical members, said beveled end of one of said plugs being in planar contact with said beveled end of the other of said plugs;

a pair of circular bubble levels, each of said levels having a base secured to said free end of one of said plugs and a curved upper portion the outermost part of which is substantially tangential with the plane defined by said open end of one of said cylindrical members, said bases of said levels defining

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mutually perpendicular planes, whereby to respectively indicate deviation from the horizontal of a first datum plane and a second datum plane, said datum planes being mutually perpendicular.

2. In combination with a leveling device according to claim 1, a portable electric drill having a drill axis and means for mounting said leveling device on said drill so that one of said levels indicates deviation of said drill axis from the horizontal and said other of said levels indicates deviation of said drill axis from the vertical.

3. In an improved handle for a motor driven tool having a working axis, the improvement which comprises:

a first hollow cylindrical member having an axis aligned with said working axis;

a first resilient cylindrical plug within said member and having an outer end perpendicular to the axis in said member;

means mounting said first plug within said member;

a second hollow cylindrical member having an axis perpendicular to said working axis, said members being joined at right angles;

a second resilient cylindrical plug having an outer end perpendicular to the axis of said second member, said outer ends of said plugs being mutually perpendicular, said plugs further including beveled ends in planar contact within said members;

means mounting said second plug within said second chamber; and

a second circular bubble level secured to said outer end of said second plug within said second member.

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